

1/12°North Atlantic HYCOM Development

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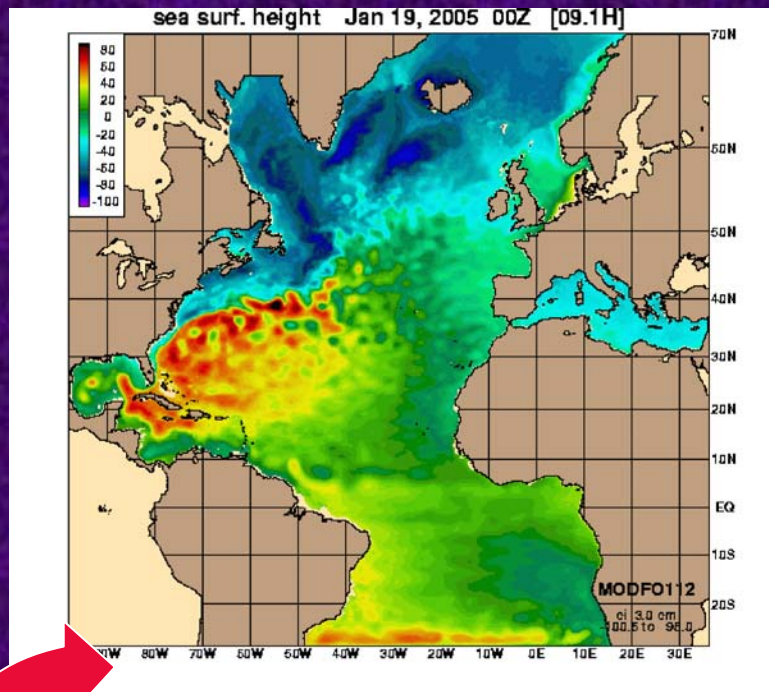
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RSMAS, University of Miami, FL
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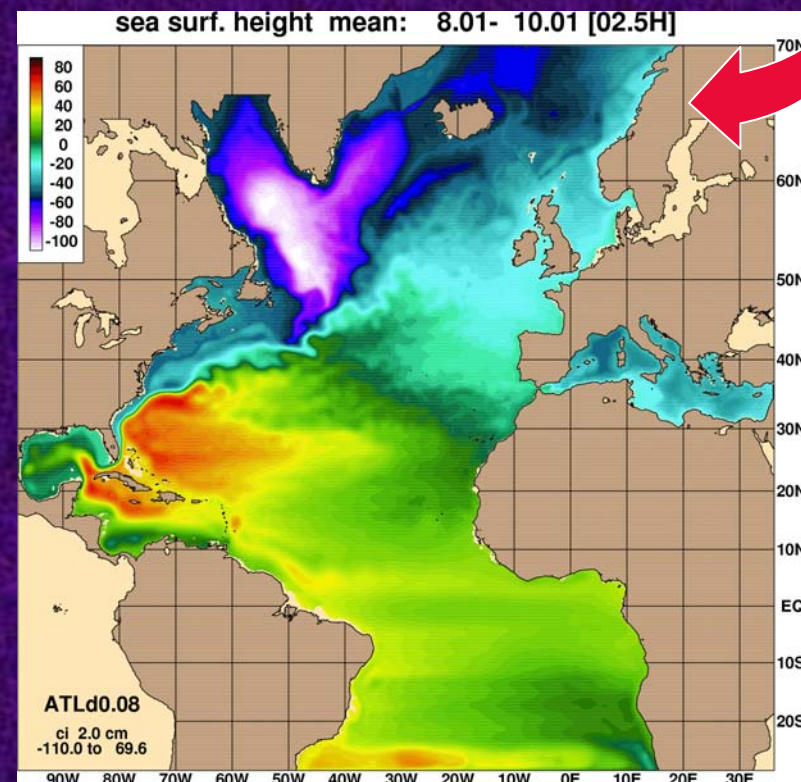
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Motivation: Improved Model Component in 1/12° Atlantic-HYCOM Nowcast/Forecast System



Present Day Near Real Time
Data-assimilative Run
(<http://www7320.nrlssc.navy.mil>)

Climatological Spin-Up
To Real Time System



Two-Year Mean SSH

Atlantic Basin-Scale Model Evaluation Methodology: First Order Requirements

Mean and Variability of large-scale currents

Realism of wind-driven flow

Meridional Overturning Cell (thermohaline driven)

- Amplitude

- Characteristics of deep southward and
upper return flow

Transports

- Through passages

- Within major currents

Water mass distribution

1/12° ATL-HYCOM Development

Boundary relaxation time scale

- Impact on MOC amplitude

Advection scheme (MPDATA vs FCT2)

- Impact on subpolar gyre mixed layer depth

- Impact on MOC amplitude

Vertical coordinate:

- σ_0 w/ and w/o variable target ρ

 - Impact Mediterranean circulation

- σ_2^*

 - Impact on Mediterranean salinity outflow

 - Impact on AABW

Bottom topography (sills)

- Impact on flow pathways

Diffusion parameterization

- Impact on major currents (strength and pathway) and energy levels

Wind Forcing

- Impact on large-scale current systems

Turbulent mixing scheme

- Impact on diffusion

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1/12° Atlantic HYCOM Configuration

28°S to 70°N; 1/12° (7 km mid-lat); 26 or 28 layers; σ_0 or σ_2^*

Topography from NRL-DBDB2

Hand edited after interpolation to model grid

Monthly GDEM3 climatology

Initialization (July); SSS and lateral open boundary relaxation

KPP or GISS turbulent mixing model

ERA-15 monthly mean forcing + high-frequency wind anomalies

Corrected strength of winds

River runoff included

Major rivers only at this time

kpar turbidity

Bulk formulation for sensible and latent heat fluxes

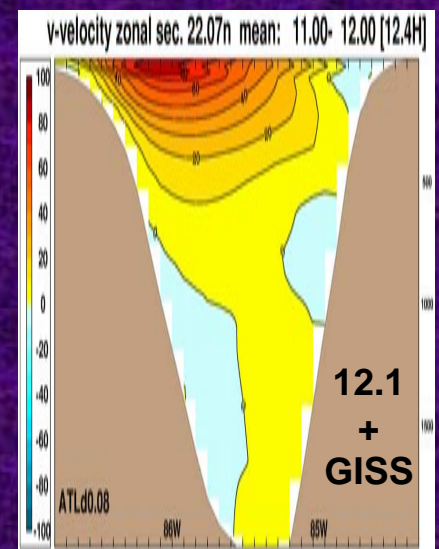
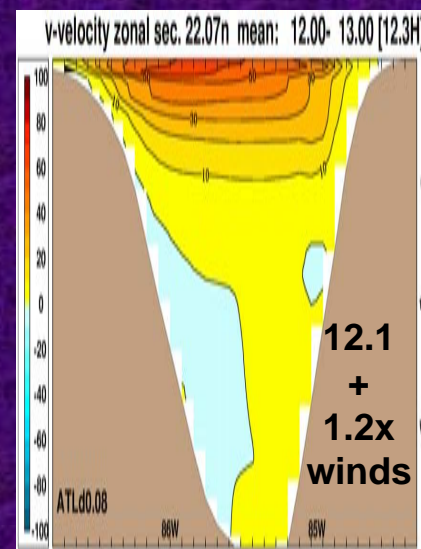
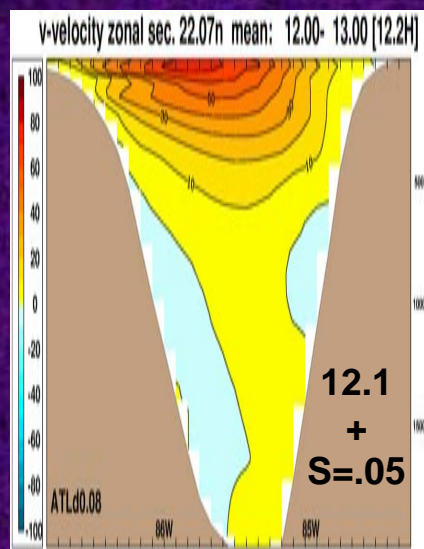
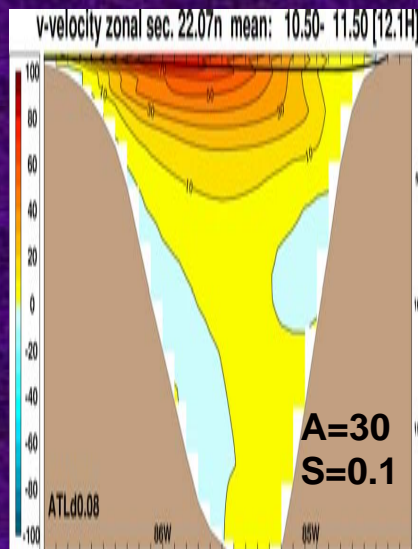
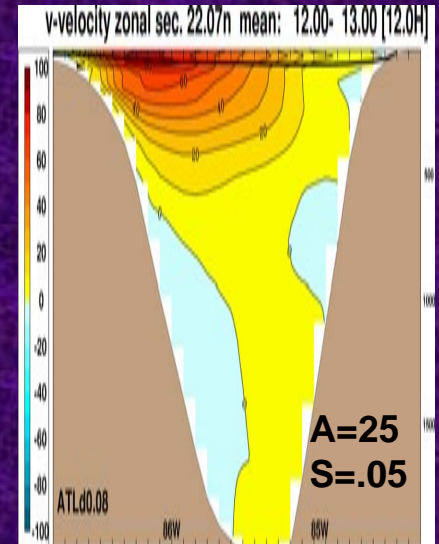
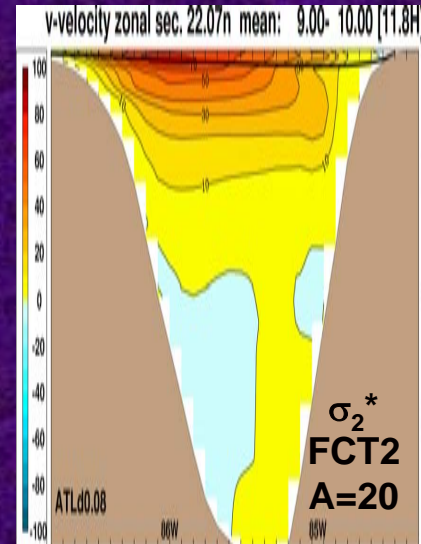
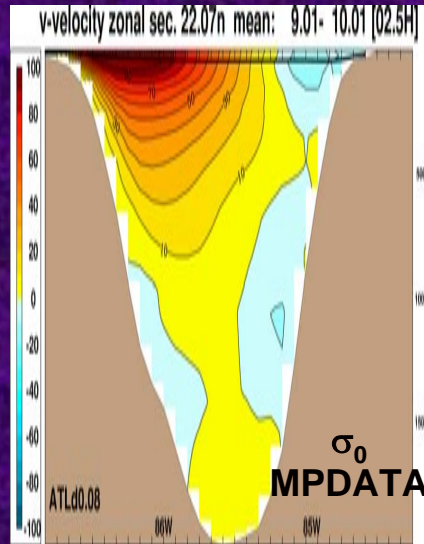
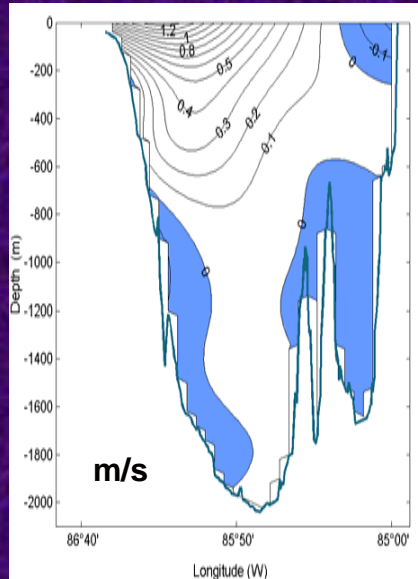
Energy loan ice model

1/12° ATL-HYCOM Twin Experiments

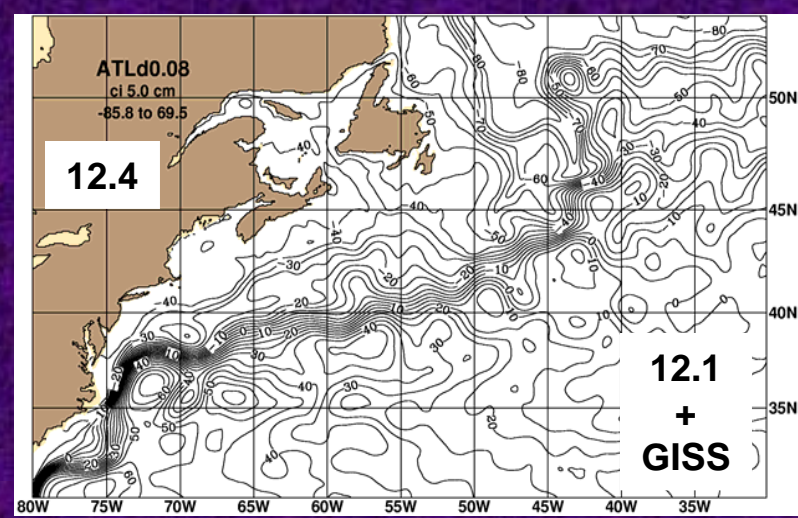
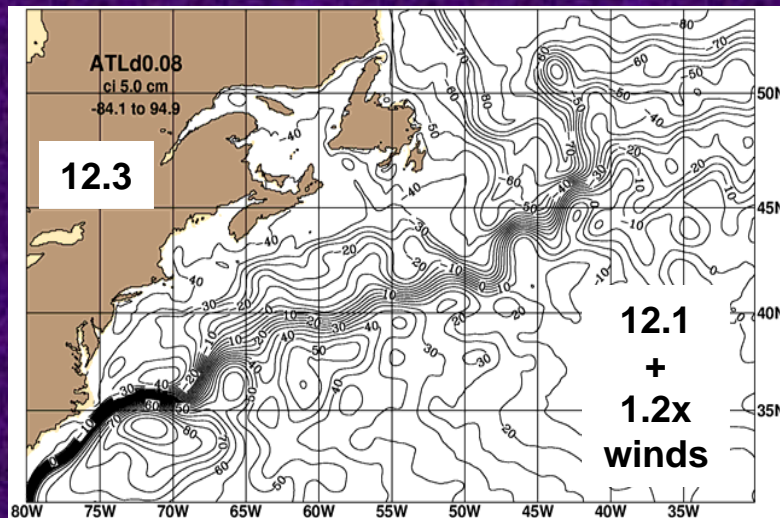
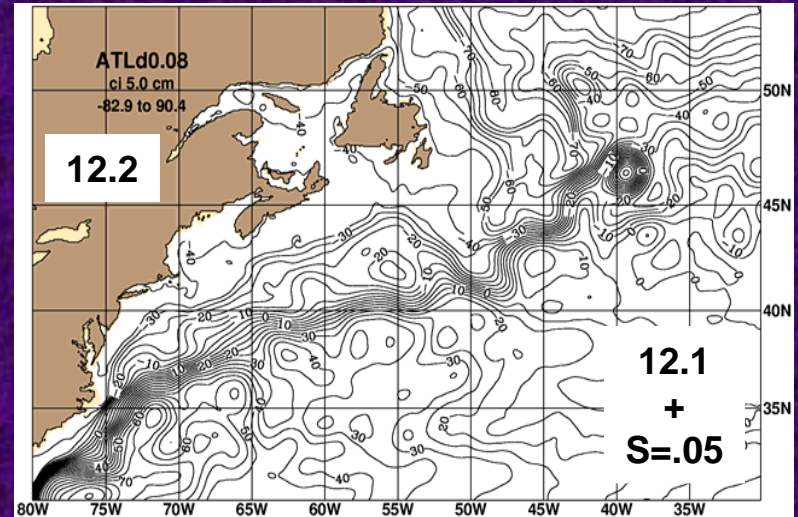
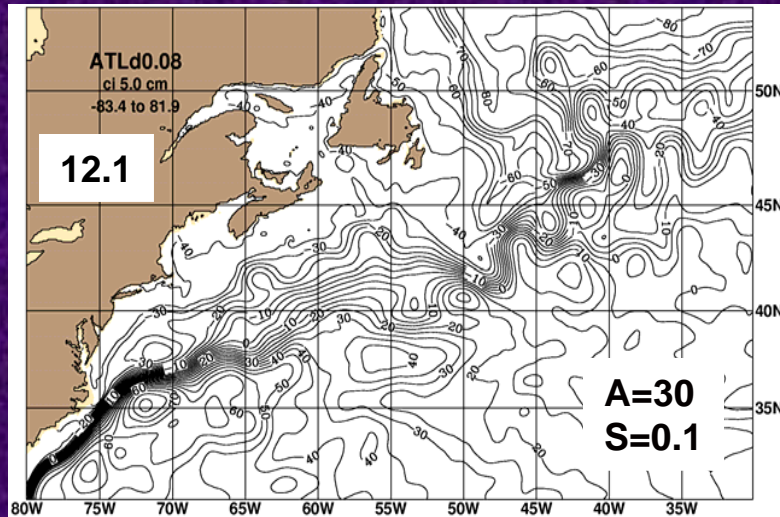
| Experiment | Smag. Diffusion | Spatially Constant A | Mixed Layer | Model Years | C _b | Other |
|---------------|--------------------|----------------------------|----------------|----------------|----------------|-----------------------|
| ATLd0.08-11.8 | .05 | 20 | KPP | 09-10 | .02 | Improved WWI sills |
| ATLd0.08-12.0 | .05 | 25 | KPP | 11-13 | .022 | Improved FS sill |
| ATLd0.08-12.1 | .1 | 30 | KPP | 11-15 | .022 | |
| ATLd0.08-12.2 | .05 | 30 | KPP | 11-13 | .022 | |
| ATLd0.08-12.3 | .1 | 30 | KPP | 11-13 | .022 | 1.2x winds |
| ATLd0.08-12.4 | .1 | 30 | GISS | 11-13 | .022 | |

Yucatan Channel Annual Mean Velocity

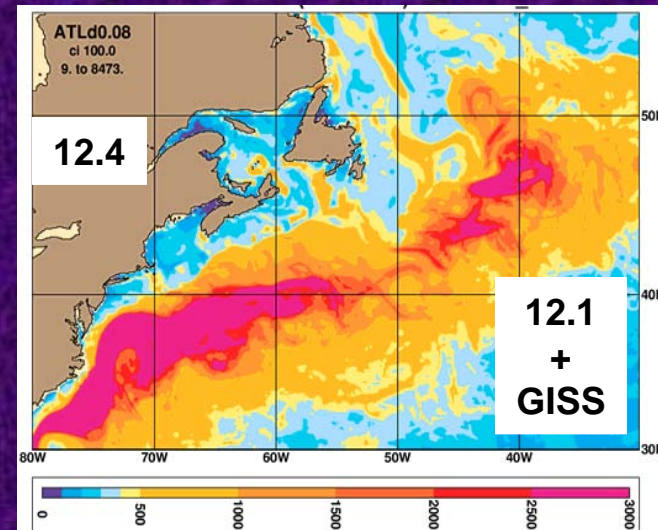
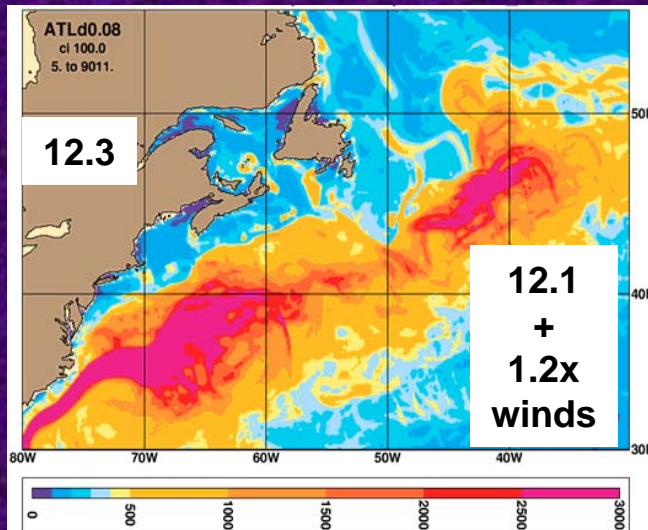
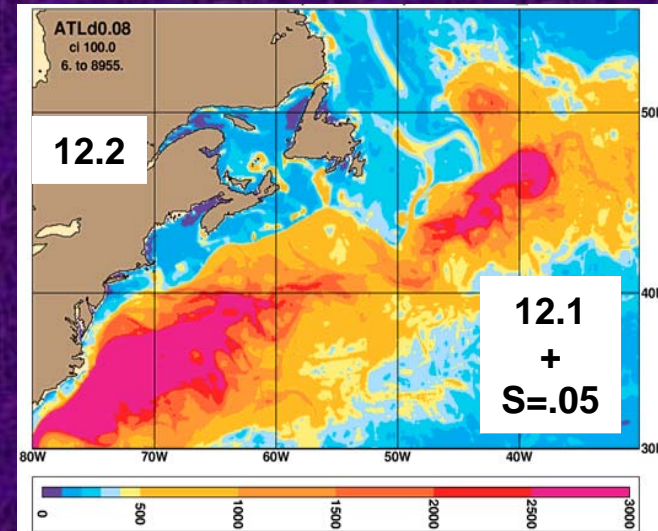
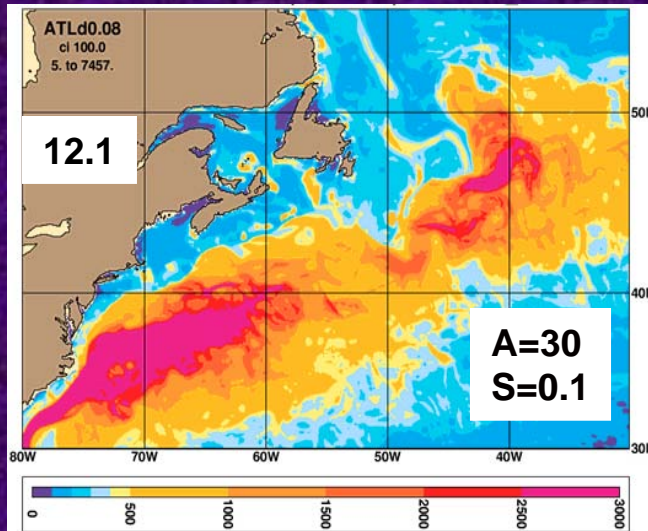
1/12° Atlantic HYCOM



1/12° Atlantic HYCOM 2-Year Mean SSH



1/12° Atlantic HYCOM Layer 1 EKE (cm^2/s^2)



1/12° Atlantic Hycom

Two-year Mean Transports*

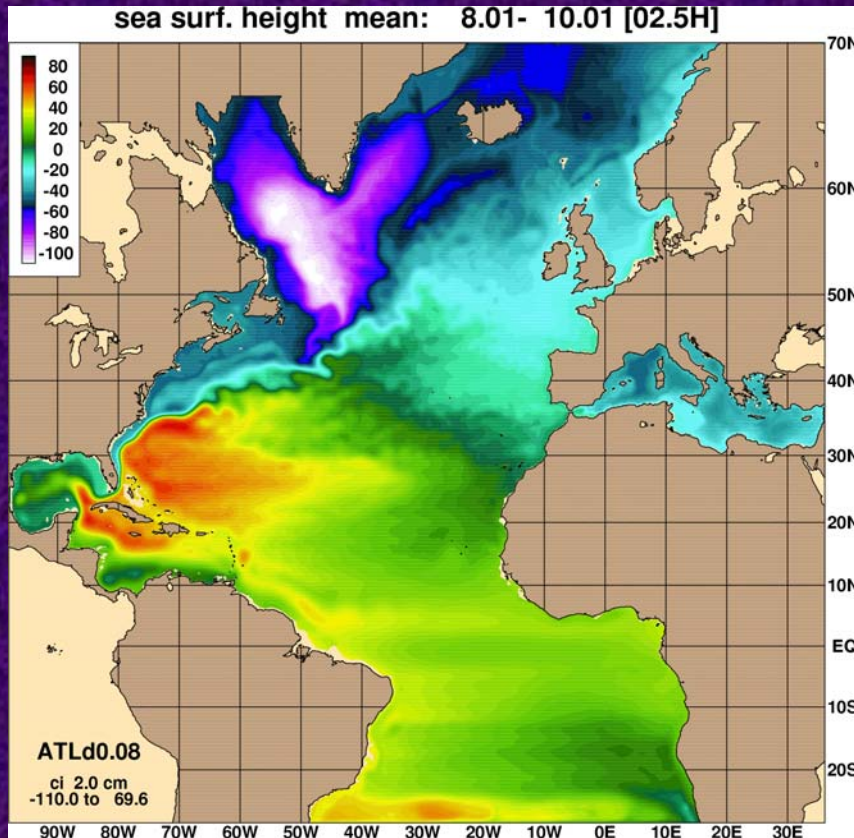
| Expt. | FC 27°N | Abac (nrth) | FC + Abac | NWP | OBC | Yuc Chan | WW | Mona | Aneg | L.A.# | Lucia Vinc e Gren |
|-------|------------|----------------|--------------|------|------|-------------|------|------|------|-------|----------------------------|
| Obs | 32 | 5 | 37 | -1.2 | -1.9 | 29.2 | -7.0 | -2.6 | -2.5 | -17.1 | -10.1 |
| 11.8 | 27.9 | 20.8 | 48.7 | -3.3 | 1.1 | 25.7 | -3.3 | -3.8 | -1.7 | -16.9 | -11.4 |
| 12.0 | 27.7 | 16.6 | 44.3 | -2.7 | 1.1 | 25.8 | -3.2 | -5.7 | -1.7 | -15.5 | -9.9 |
| 12.1 | 26.8 | 6.8 | 33.6 | -3.2 | 1.0 | 24.5 | -3.3 | -3.9 | -1.3 | -16.2 | -10.2 |
| 12.2 | 27.4 | 7.4 | 34.8 | -3.6 | 0.9 | 24.7 | -4.8 | -3.5 | -1.3 | -15.2 | -9.4 |
| 12.3 | 28.3 | 4.7 | 33.0 | -4.0 | 1.0 | 25.3 | -1.9 | -4.9 | -2.3 | -16.1 | -10.3 |
| 12.4 | 25.9 | 5.4 | 31.3 | -3.1 | 0.9 | 23.7 | -2.5 | -3.9 | -1.2 | -16.2 | -11.1 |

* Positive transport defined northward and eastward

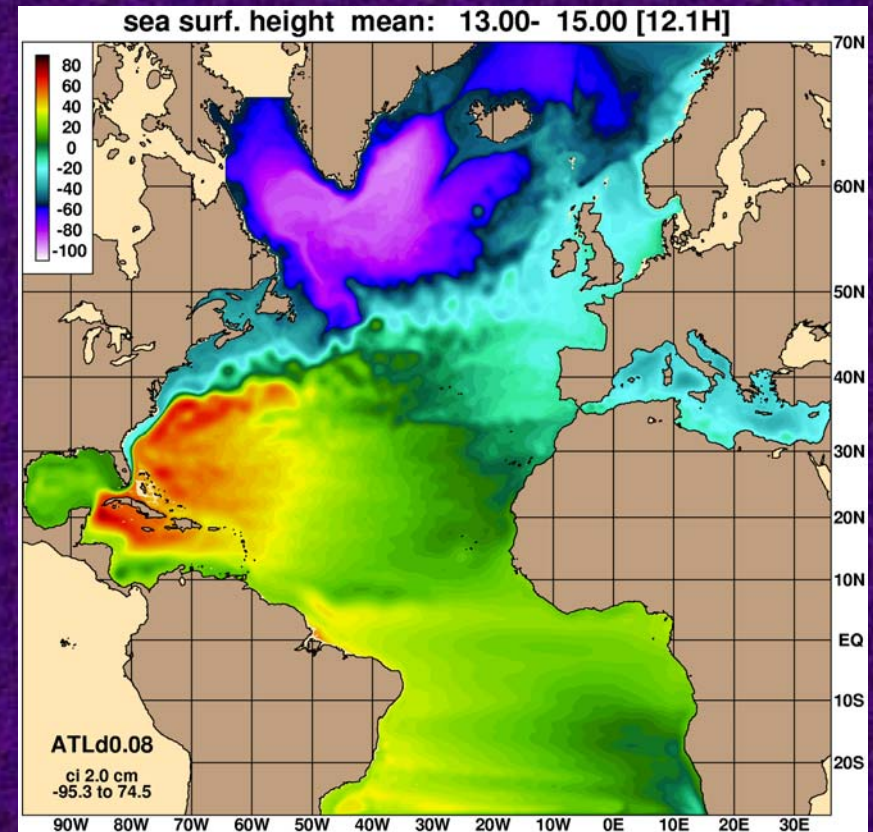
Residual of Yucatan – WW – Mona - Anegada

1/12° ATL-HYCOM Mean Sea Surface Height

Present Nowcast/Forecast System Model



Improved Model



ERA-15 wind (+ high-frequency anomalies) and thermal forcing
and relaxation to GDEM3 at northern and southern boundaries

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Variable Reference State